WHAT IS CLAIMED IS:

1. A method of producing a glass substrate for a mask blank, the method comprising:

a profile measuring step of measuring a convex/concave profile of a surface of the glass substrate for a mask blank;

a flatness control step of controlling a flatness of the surface of the glass substrate to a value not greater than a predetermined reference value by specifying the degree of convexity of a convex portion present on the surface of the glass substrate with reference to a result of measurement obtained in the profile measuring step and executing local machining upon the convex portion under a machining condition depending upon the degree of convexity; and

a polishing step of polishing, after the flatness control step, the surface of the glass substrate subjected to the local machining; wherein:

the surface of the glass substrate subjected to the local machining is subjected to acid treatment after the flatness control step and before the polishing step.

2. A method of producing a glass substrate for a mask blank, the method comprising:

a profile measuring step of measuring a convex/concave profile of a surface of the glass substrate for a mask blank;

a flatness control step of controlling a flatness of the surface of the glass substrate to a value not greater than a predetermined reference value by specifying the degree of convexity of a convex portion present on the surface of the glass substrate with reference to a result of measurement obtained in the profile measuring step and executing local machining upon the convex portion under a machining condition depending upon the degree of convexity; and

a polishing step of polishing, after the flatness control step, the surface of the glass substrate subjected to the local machining; wherein:

the surface of the glass substrate subjected to the local machining is subjected to alkali treatment after the flatness control step and before the polishing step.

3. A method according to claim 1 or 2, wherein the local machining is carried out by plasma etching or a gas cluster ion beam.

4. A method according to claim 1, wherein an acid used in the acid treatment is fluorosilicic acid and/or hydrofluoric acid.

5. A method according to claim 1, wherein an acid used in the acid treatment is sulfuric acid.

6. A method according to claim 1, wherein the surface of the glass substrate subjected to the acid treatment is subjected to alkali treatment after the acid treatment.

7. A method according to claim 1 or 2, wherein the reference value is not greater than 0.25 μm.

8. A method of producing a mask blank, the method comprising the steps of preparing the glass substrate obtained by the method according to any one of claims 1 to 7, and forming a thin film as a transferred pattern on the glass substrate.

9. A method of producing a transfer mask, the method comprising the steps of preparing the mask blank obtained by the method according to claim 8 and patterning the thin film of the mask blank to form a thin film pattern on the glass substrate.

10. A method of producing a semiconductor device, the method comprising the steps of preparing the transfer mask obtained by the method according to claim 9 and transferring the thin film pattern of the transfer mask onto a semiconductor substrate by lithography.